Production of Natural Gas and Fluid Flow in Tight Sand Reservoirs

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The dependencies between macroscopic tight sand gas reservoir parameters and microscopic fluid flow dynamics are investigated by identifying the main transport mechanisms at the pore scale that should affect fluids flow at the reservoir scale. A critical review of commercial reservoir simulators, used to predict tight sand gas reservoir, revealed that many are deficient when used to model fluid flow through tight reservoirs. Conventional simulators ignore altogether or modeled incorrectly certain phenomena such as, Knudsen diffusion, electro-kinetic effects, ordinary diffusion mechanisms and water vaporization. We studied the effect of Knudsen's number in Klinkenberg's equation and evaluated the effect of different flow regimes on Klinkenberg's parameter *b*. We developed a model capable of explaining the pressure dependence of this parameter that has been experimentally observed but ignored in the usual formalisms. We demonstrated the relevance of this, so far ignored effect, in tight sands reservoir modeling. A 2-D numerical simulator based on equations that capture the above mentioned phenomena was developed. Dynamic implications of new equations are comprehensively discussed in our work and their relative contribution to the flow rate is evaluated. We performed several simulation sensitivity studies that evidenced that, in general terms, our formalism should be implemented in order to get more reliable tight sands gas reservoirs' predictions.